

## Balanced Expertise Distribution in Remote Ultrasound Imaging Aboard The International Space Station (ISS)

### Introduction:

Astronaut training for ISS operations usually ensures independent performance. With small crew size same crews also conduct all science work onboard. With diverse backgrounds, a good "match" between the existing and required skills can only be anecdotal. Furthermore, full proficiency in most of the complex tasks can be attained only through long training and practice, which may not be justified and may be impossible given the scarcity of training time. To enable a number of operational and science advancements, authors have developed a new approach to expertise distribution in time and among the space and ground personnel.

### Methods:

As part of NASA Operational Ultrasound Project (1998-2003) and the NASA-solicited experiment "Advanced Diagnostic Ultrasound in Microgravity-ADUM" (P.I. -S.D., ongoing), the authors have created a "Balanced Expertise Distribution" approach to perform complex ultrasound imaging tasks on ISS for both operational and science use. The four components of expertise are a) any pre-existing pertinent expertise; b) limited preflight training c) adaptive onboard proficiency enhancement tools; d) real-time guidance from the ground. Throughout the pre-flight training and flight time preceding the experiments, the four components are shaped in a dynamic fashion to meet in an optimum combination during the experiment sessions.

### Results:

Procedure validation sessions and feasibility studies have given encouraging results. While several successful real-time remote guidance sessions have been conducted on ISS, Expedition 8 is the first to use an "on-orbit proficiency enhancement" tool.

### Conclusions:

In spite of severely limited training time, daring peer-reviewed research and operational enhancements are feasible through a balanced distribution of expertise in time, as well as among the crewmembers and ground personnel. This approach shows great promise for biomedical research, but may be applicable for other areas of microgravity-based science.